Big Top User Guide

Tools > Performance

2007-10-31

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Apple Inc.
1 Infinite Loop
Cupertino, CA 95014
408-996-1010

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Introduction

Overview

BigTop is a tool for monitoring the overall resource utilization of Macintosh systems, either locally or remotely over the network. Effectively, BigTop puts a graphical front end onto the traditional UNIX `top` command. It allows you to visualize resource utilization trends with charts and to summarize the state of the various subsystems for each monitored machine. In addition, using the network support, BigTop can also show you a high-level overview of the functionality of large groups of machines.

Philosophy

The performance of complex computer systems can be difficult to comprehend. BigTop lets you easily monitor the health of your systems to look for problems and give you a starting point for in-depth analysis.

BigTop records the activity on a system by periodically collecting performance statistics from the underlying operating system. This statistics collection typically requires less than 5% of the CPU time, so its performance impact, while not zero, is fairly small. Metrics such as CPU utilization, amount of disk I/O, etc., provide a wealth of information about the current state of each subsystem. While each of these pieces of data are useful on their own, BigTop consolidates them together so that you can easily see which parts of a system are limiting performance.

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Introduction

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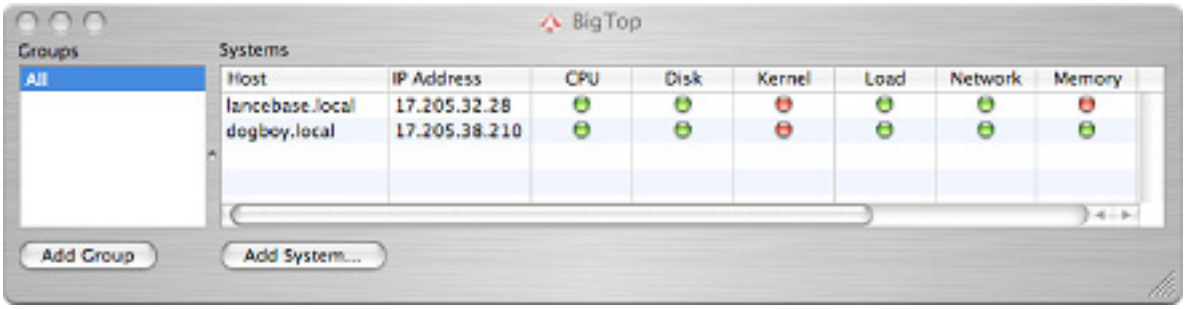
Using BigTop

After launching BigTop for the first time you will be presented with the *Main Window*, as described in "The Main Window" (page 9), and a *System Window*, as described in "The System Window" (page 12), for the local machine. This chapter gives an overview of how you can use the controls and graphs in these two windows to examine how your system is being used. In addition, it covers some of the ways that you can customize the display to make it fit your needs.

The Main Window

The *Main Window*, illustrated in Figure 1-1, gives a brief overview of all monitored machines and allows you to open up *System Windows* for any systems that you would like to investigate in more detail. Normally this window is open at all times while you are using BigTop, but if you close it then you can return it to the screen at any time by using the *Window* $\rightarrow$ *Network Monitor* (*Command-1*) menu command.

Figure 1-1 Main Window



Managing Systems and Groups

By default, there is only a single machine (the local system) listed in the *Systems Table*, which occupies the right part of the main window. You can add additional machines to monitor by pressing the *Add System...* button at the bottom of the window and then using the sheet (see Figure 1-2) that appears.

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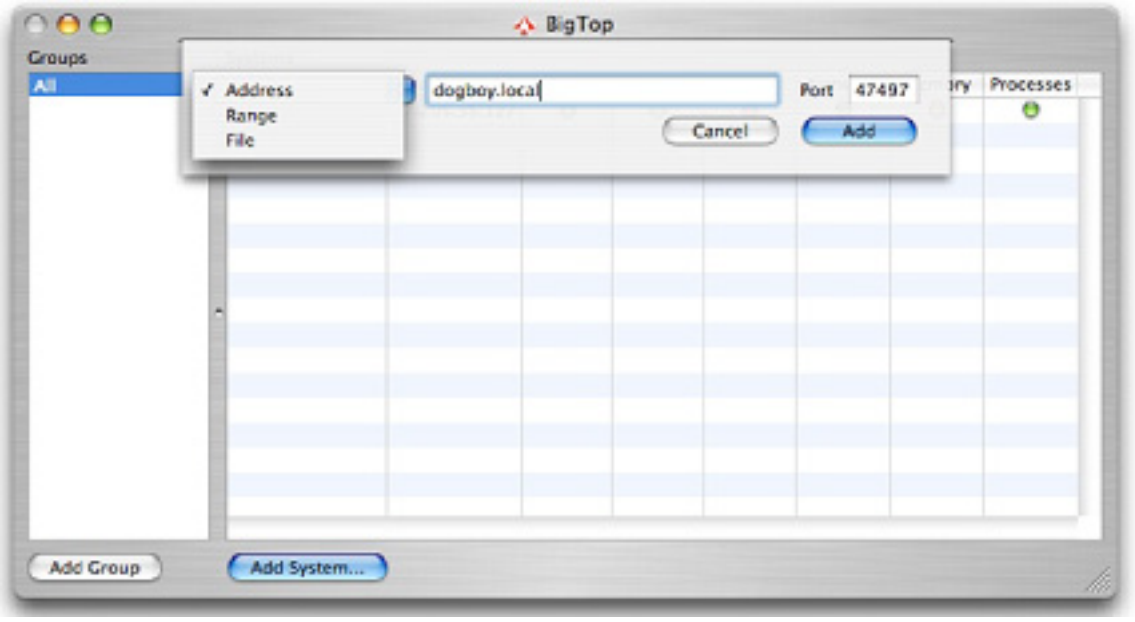
Figure 1-2 Add System Dialog



Using the menu at the left end of the sheet, you can choose to add one or more systems to the list in three different ways:

- **Address**— You can select individual machines connected via the Internet by typing in their IP addresses into the blank, either numerically or by name. Machines on the local network should generally be connected using their short names used for Apple file sharing (such as "dogboy.local") instead of their full Internet names (such as "dogboy.mycompany.com"), as this method will work even if the local computers have temporary IP addresses acquired via a DHCP server. You may also choose a different IP port number using the text box to the right, if the default value of 47497 is blocked by your firewall.
- **Range**— You can select an entire range of numeric IP addresses to monitor. This is an excellent way to add an entire cluster of machines at once. As with the individual address option, you may also choose a different IP port number using the text box to the right, if the default value of 47497 is blocked by your firewall.
- **File**— You can select a text file containing a list of Internet addresses (name or number), one address per line. You can enter the name of the file manually in the text box, or press the "Select" button that appears at the right end of the sheet to This is a fast and effective way of adding a common set of computers. Alternate ports may be selected using the standard Internet notation of adding `:<port number>` to the end of each address.

Any machine that is added must have the `/usr/libexec/statsCollector` daemon running, as this daemon is responsible for actually doing the underlying statistics collection and shoveling data through the network to any copies of BigTop that are listening. BigTop will automatically start this daemon when the application is started, allowing both the local copy of BigTop and any remote systems to monitor that computer. You should note, however, that on systems where you cannot run BigTop — such as headless servers — you will need to start this daemon manually. The `-p <port #>` option should be used to set the port number if the default of 47497 is blocked.

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The *Systems Table* alone is great if you just want to examine a few systems. For larger collections of computers, however, you may need more organization. The *Groups Table*, which occupies the left half of the main window, gives you a way to manage logical collections of machines on your network without continually adding and deleting those systems from the *Systems Table*. By default, BigTop shows you all of the machines being monitored (the "All" group). You can add groups to the *Groups Table* by selecting the *Add Group* button at the bottom of the window. Double-click on the new group in the *Groups Table* to edit the name. After creating a group, you can add machines to it by selecting the main ("All") list and then dragging and dropping systems from the *Systems Table* to the group name. You can delete groups by selecting them in the *Groups Table* and selecting *Edit Delete* (*Delete*).

The Systems Summary Table

The *Systems Table* lists all of the monitored machines (one per row) with a summary icon for each subsystem, allowing you to get a quick overview of the status of many machines at once:

- **CPU**— This gives an indication about the % of time that the processor(s) are active.
- **Disk**— This indicates the total number of bytes read from and written to disk per second.
- **Kernel**— The gives an indication of the number of kernel-managed threads currently executing on the system.
- **Network**— This indicates the total number of bytes coming in from and going out to the active network interfaces on this computer each second.
- **Memory**— This gives an indication about the % of the main memory that has been allocated.
- **Processes**— This gives an indication of the total number of processes.

Three additional types of statistics may be displayed or hidden by selecting the *View Show/Hide Advanced Statistics* (*Command-Shift-M*):

- **Load**— This gives an indication of average system load (number of active, non-blocked threads) on the system.
- **Swap**— This indicates the % of available disk space that can be used for virtual memory page swapping has already been allocated.
- **VM**— This gives an indication of the number of page faults that are occurring per second on the system.

The availability of some kinds of advanced statistics depends on the version of the operating system running on the machine being monitored.

The state of each sub-system is summarized with an icon:

Disconnected

Low Utilization

Medium Utilization

High Utilization

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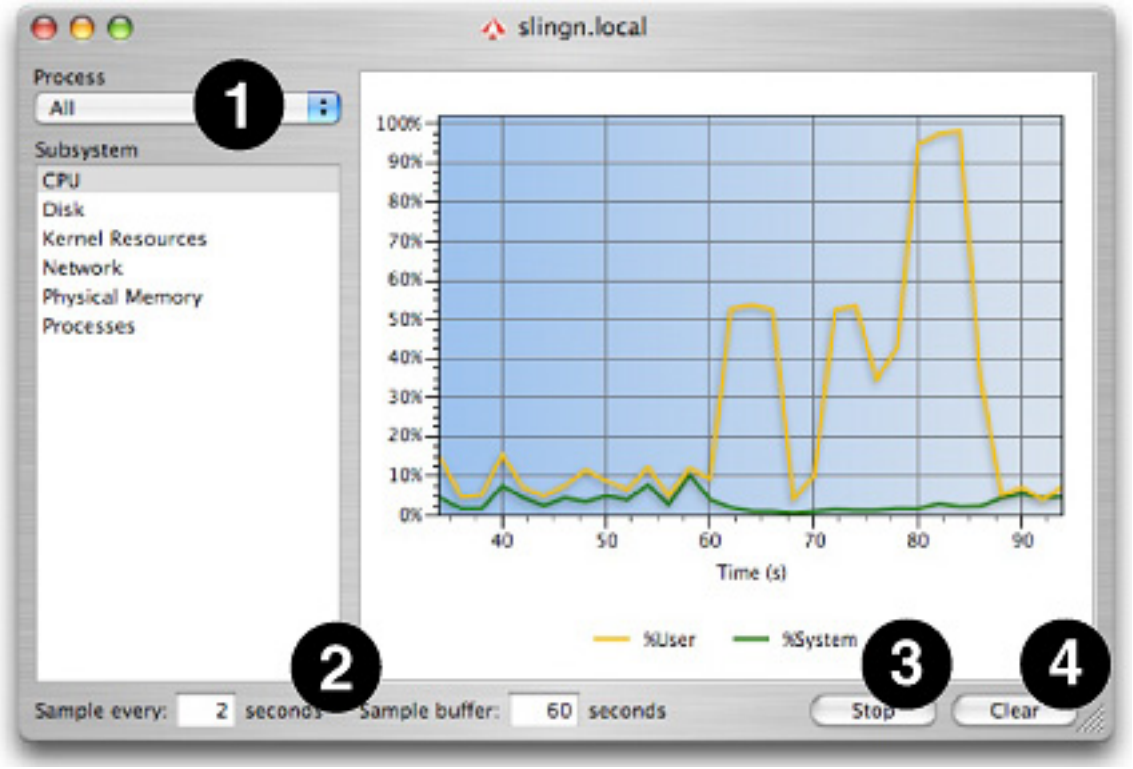
The exact meaning of these various icons can be controlled using the "Alert Levels" editing function, as explained in "Alert Levels Editor Window" (page 18).

The System Window

Each monitored system can be examined in detail by double-clicking its row in the *Systems Table* to bring up a Figure 1-3.

Figure 1-3 System Window



The system window shows a graph of the selected subsystem's performance metrics over time. By selecting different options from the *Subsystem List* at the left side of the window, you can choose to examine a variety of different types of system statistics, most of which correspond to summary icons in the *Main Window*:

- **CPU**— This shows the breakdown in CPU utilization between user, system, and idle time.
- **Disk**— This indicates the total number of bytes read from and written to disk per second.
- **Kernel Resources**— The shows the number of kernel-managed threads currently executing on the system.
- **Network**— This indicates the total number of bytes coming in from and going out to the active network interfaces on this computer each second.
- **Physical Memory**— This shows how the main memory is being used, showing the major types of memory breakdowns used by Mac OS X:

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- *Resident Memory*— This read-write part of main memory is allocated to single processes on a page-by-page basis, privately, and can be paged off to disk, if necessary.
- *Shared Resident Memory*— This read-only section of main memory is allocated to multiple processes at once on a page-by-page basis, and can be paged off to disk if necessary.
- *Private Resident Memory*— This is the size of the private, paged "resident memory" plus all private memory allocated to the OS at startup time for core kernel functions, which is never paged. Normally, this will just be a fixed offset above the *Resident Memory* line.
- *Idle Memory*— You can determine the amount of idle memory by subtracting the *Shared Resident Memory* and *Private Resident Memory* figures from the total amount of main memory in the system.

- **Processes**— This shows the total number of processes, and breaks these down into active and sleeping processes.

Four additional types of statistics may be displayed or hidden by selecting the *View→Show/Hide Advanced Statistics* (*Command-Shift-M*):

- **Load**— This displays average system load (number of active, non-blocked threads) over the past minute, five minutes, and fifteen minutes.
- **Shared Libraries**— This displays the memory size devoted to code, data, and LinkEdit information associated with the currently loaded Mac OS X dynamically-linked shared libraries. There is no equivalent for this entry among the icons in the main window.
- **Swap**— This displays the amount of used and remaining disk space that can be used for virtual memory page swapping.
- **VM Faults**— This displays the total number of virtual memory page faults per second and breaks them down into the various kinds possible with Mac OS X:
  - *Page Ins*— The desired page was not resident in memory, and had to be brought in from disk.
  - *Page Outs*— A page had to be forced out of memory to disk in order to free up space. These faults are usually accompanied by one of another type that indicates the kind of space needed.
  - *Zero-Fill Faults*— A new page of blank, uninitialized memory was allocated.
  - *Copy-on-Write Faults*— A read-only page shared among two or more processes was written by one of the sharers, forcing the OS to make a private, read-write copy of the page for that process.
  - *Page Cache Reactivations*— The desired page was present in memory, but not listed in the system page tables. The OS just needed to add the entry back into the page tables before letting the process continue.

In addition, there are several other, more minor ways that you can choose to modify this display using the other controls scattered around the periphery of the window:

1. **Process Popup Menu**— By default, statistics are shown for the entire system. You can zero in on a specific application's behavior by selecting it from this menu. The same set of performance metrics may not be available for both the system-wide and per-process views.
2. **Sample Rate and Buffer Size**— By default, performance data is sampled every two seconds and the last sixty seconds worth of samples are displayed. However, these two values can be changed locally with the two text boxes in the bottom-left part of the window, or globally in the preferences (see "Sampling Preferences" (page 15)).

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3. **Stop Button**— If you are done examining a system with BigTop, you can stop the `statsCollector` daemon on that system with the *Stop* button. Note that once you press this button, you will need to restart BigTop on the system in order to restart the daemon.

4. **Clear Button**— This clears the buffer used to display data in the graph. You may want to use it after BigTop has been running for awhile.

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Preferences

Global preferences for BigTop are set using two different windows: the normal application *Preferences* window (see "Preferences Window" (page 15)) and the *Alert Levels* window, described in "Alert Levels Editor Window" (page 18), which controls the resource levels used to trigger resource alert indicators in the *System Window* (see "The Systems Summary Table" (page 11)).

Preferences Window

BigTop's general preferences are accessed from the *BigTop preferences...* menu item and allow you to set persistent preferences that will be restored each time BigTop is launched. BigTop's preference panel is divided into two tabbed views: *Sampling* and *Chart*, which are described in the following two subsections.

Sampling Preferences

The *Sampling* tab, illustrated in Figure 2-1, allows you to modify the default sampling interval and sampling buffer sizes for the graphs in new *System Windows* by specifying new values for these two numbers in the supplied text boxes. As indicated, all values are in seconds.

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Figure 2-1 Sampling Preferences

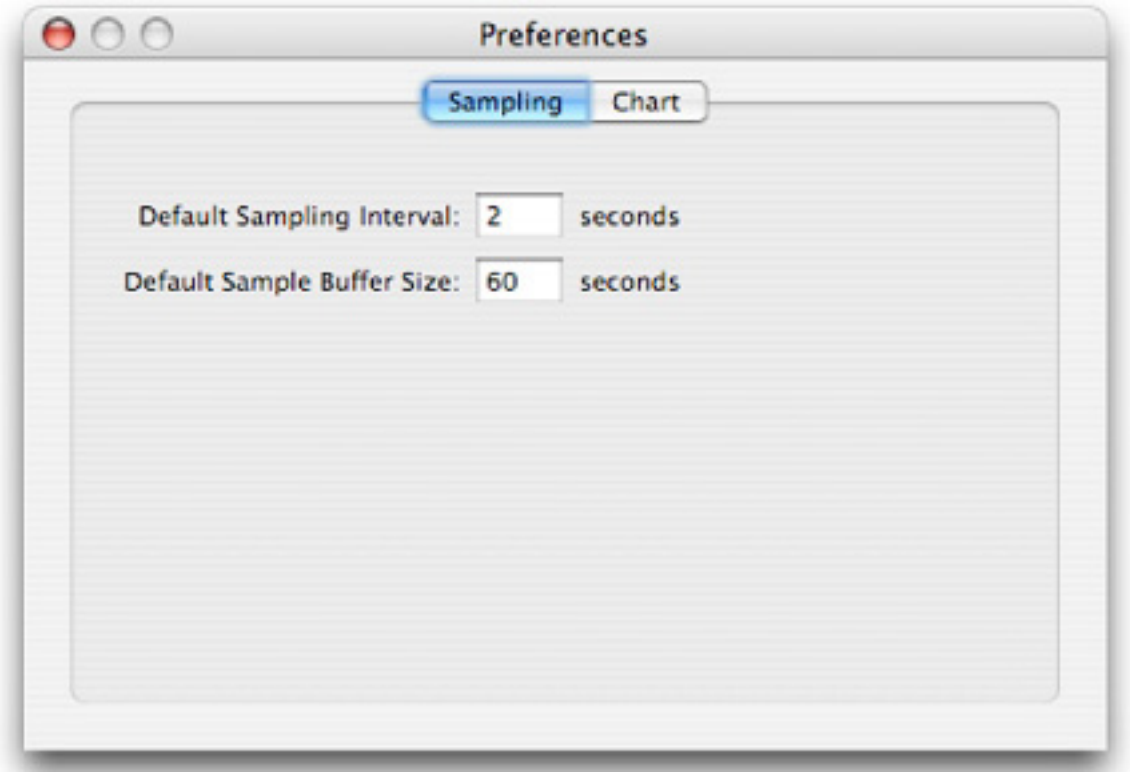

Chart Preferences

The *Chart* tab, illustrated in Figure 2-2, provides controls to change the appearance of the charts displayed in each *System Window*. The options are divided into four groups, which are discussed in turn below.

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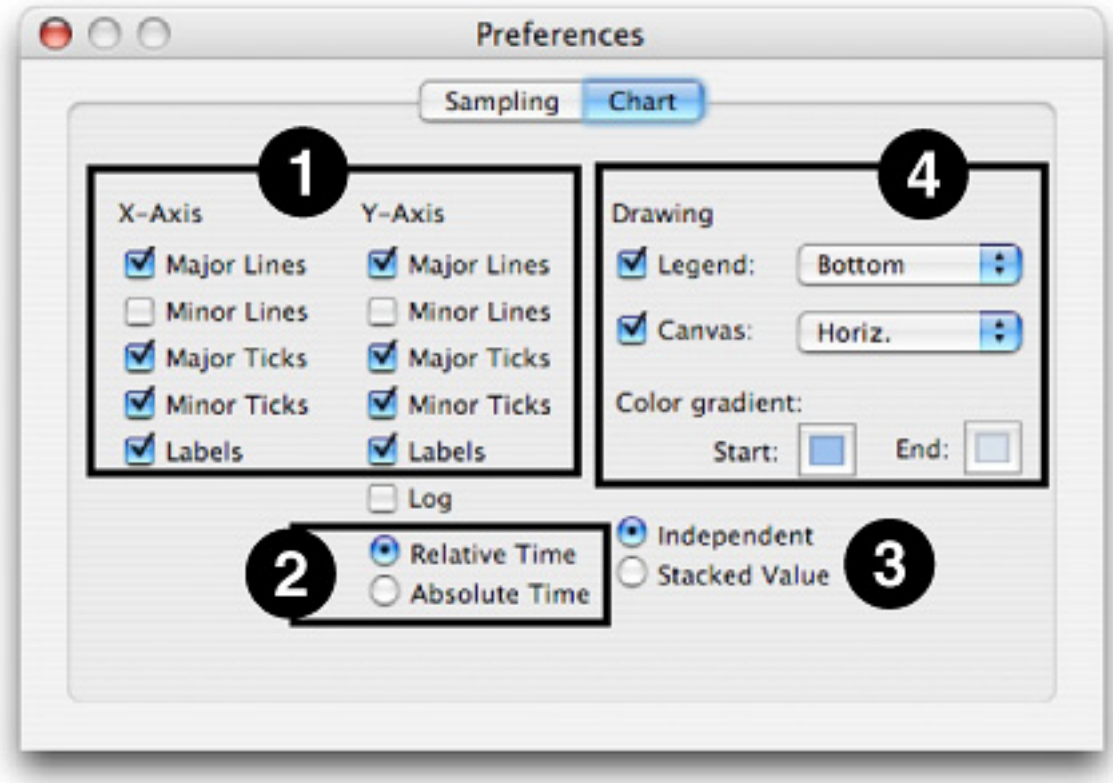
Figure 2-2 Chart preferences



1. **Axis Appearance**— This group of controls sets the appearance of the two axes in each chart. Separate but identical sets of controls are supplied for each axis. All options are simple on-off flags, chosen with checkboxes:

    - **Major Lines**— If checked, puts lines on the major divisions of the chart's axis.
    - **Minor Lines**— If checked, puts lines on the minor divisions of the chart's axis.
    - **Major Ticks**— If checked, puts small lines on the axis line to show where the major divisions are.
    - **Minor Ticks**— If checked, puts small lines on the axis line to show where the minor divisions are.
    - **Labels**— If checked, puts displays text on the axis next to each major division that describes the division. In general, you will almost always want this for the Y-axis, but it is usually less useful for the X-axis.

2. **X Axis Time Display**— This is just a single set of radio buttons that controls how time is displayed on the X axis:

    - **Relative Time**— If selected (the default), BigTop displays time relative to the point in time that statistics collection was initiated. You will see the time start at 0 in each new window and progress upwards. This mode is useful when you start BigTop and your workload off simultaneously.
    - **Absolute Time**— If selected, BigTop will print the 24-hour wall-clock time along the X axis, allowing you to see the actual time-of-day when the statistics were taken. This mode is better for monitoring a system continually over extended periods of time.

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3. **Y Axis Numerical Display**— These controls vary how numbers are presented on the Y axis. The controls consist of a mixture of a checkbox and a set of radio buttons:

   - **Log**— Normally BigTop uses a linear graph scale on the Y-axis. If checked, changes the vertical axis to be logarithmic. This may be useful in some cases where you are tracking two different trends that are orders of magnitude apart in value.
   - **Independent**— If selected (the default), each data line is plotted independently as a distance from the 0 point on the y-axis.
   - **Stacked value**— If selected, BigTop plots the lines more like a stacked-bar or area plot. The first data line is plotted as the distance from the 0 point on the y-axis. The second data line is plotted as a distance from the first data line on the y-axis. This continues for each subsequent data line. This mode is more useful when you are interested in the sum of the parts instead of each individual part

4. **Drawing Controls**— These modulate options relating to how Bigtop draws its chart:

   - **Legend**— When checked, BigTop displays a box containing a description of what each data line represents. Using the pop-up menu to the right, you can choose the position for this legend: to the top, bottom (the default), left, or right of the chart itself.
   - **Canvas**— When checked, BigTop fills the background of the chart with a color or gradient, using the colors supplied in the color wells just below. The plain "start" or "end" colors may be selected, or you can choose gradients between "start" and "end" running in several directions: vertical (bottom-to-top), horizontal (left-to-right), diagonal-right (lower left to upper right), or diagonal-left (upper right to lower left).
   - **Start Color**— When using a gradient background, this well sets the "start" color. Clicking it brings up the standard Mac OS X color picker.
   - **End Color**— This is the "end" color for any background gradients.

Alert Levels Editor Window

The *System Table* in BigTop's *Main Window* provides a quick and effective way to see the status of a large number of systems just by glancing at a single table. However, if the thresholds (or "alert level settings") for indicating low/medium/high utilization do not match your typical usage patterns, then the usefulness of this table can be greatly diminished.

As a result, BigTop lets you adjust these alert thresholds to your liking. The alert thresholds can be set on a per-machine basis by highlighting a system in the *System Table* within the *Main Window* and selecting *View* ▸ *Alert Levels...* (*Command-Shift-A*). You will be presented with the Figure 2-3, where you can double-click on any threshold in the "medium" or "high" columns and adjust the levels at which the indicators switch from green to yellow and yellow to red, respectively, for the resource in question. In addition, the default alert levels used for *all* new systems may be edited by choosing this command after closing the *Main Window* completely.

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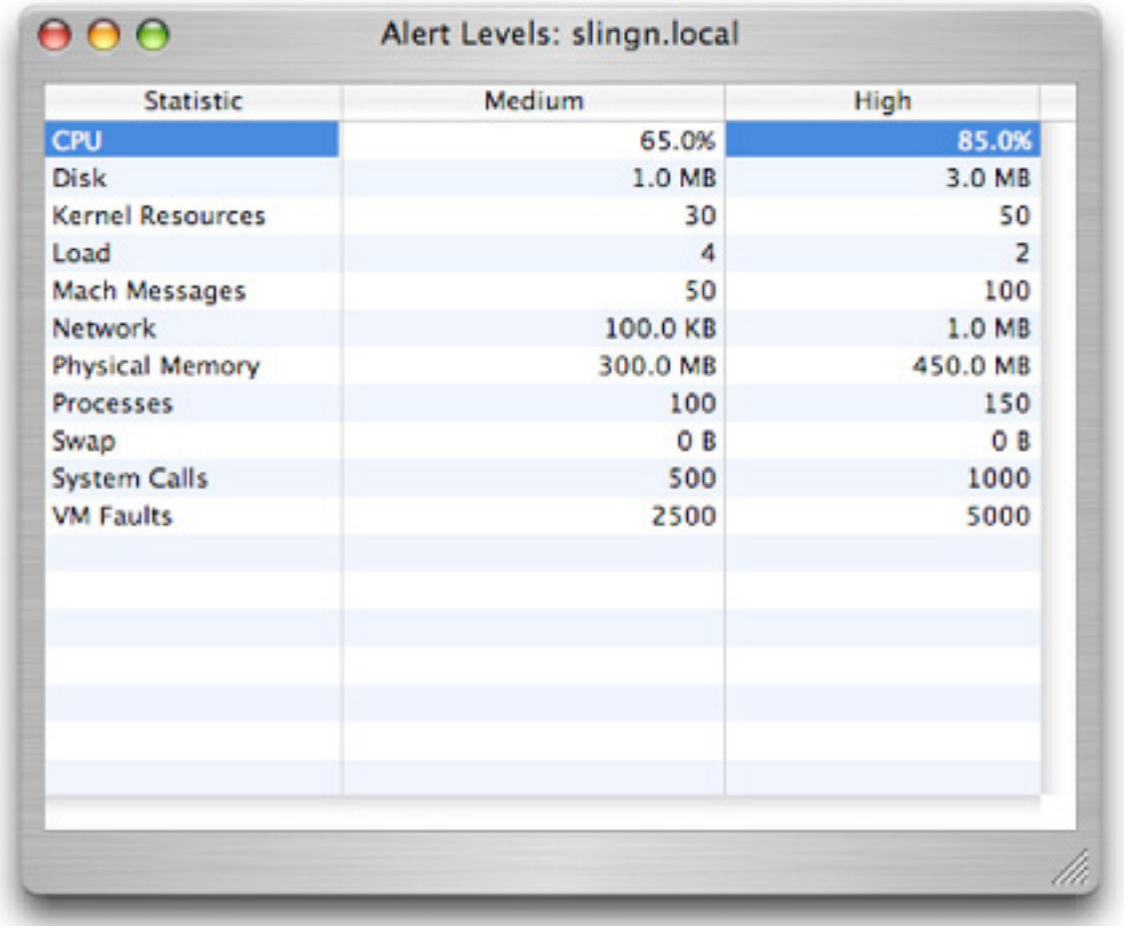
Figure 2-3 Alert Levels Editor Window



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Document Revision History

This table describes the changes to *Big Top User Guide*.

Date	Notes
2007-10-31	New document that explains how to monitor the use of resources on Macintosh computers, locally and over a network.

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Document Revision History

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